



GNSS Receiver User Manual

V2.0, modified on 2024.8.

Dear users,

Thank you for choosing SingularXYZ X1 GNSS Receiver. We recommend that you spend some time reading this User Manual in order to have a full understand of this product and get started easily.

Please read the following important factors carefully.

•RTK rover (Network Rover mode): The X1 can be used as a GNSS RTK rover. In this mode, you need to get the RTK corrections via internet (2/3/4G) in NTRIP protocol.

•RTK rover (UHF/radio rover mode): The X1 can be used as a RTK rover with the UHF mode suppose you have the existing base which can work with the radio protocols that the X1 supports.

•RTK Base station mode: You can setup the X1 as the base and stream the correction data via UHF. The X1 supports most common UHF/radio protocols in the market.

•Static mode: The X1 can be used as static mode to collect GNSS raw data for post processing.

Related Regulations

The receiver contains integral Bluetooth wireless technology and UHF. Regulations regarding the use of the datalink vary greatly from country to country. In some countries, the unit can be used without obtaining an end-user license. But in some countries the administrative permissions are required. For license information, please consult your local dealer.

Technical Assistant

If you have any question and can't find the answer in this manual, please contact your local dealer from which you purchased the X1 receiver. Alternatively, request technical support from SingularXYZ.

Website: <u>www.singularxyz.com</u> or technical support email: <u>support@singularxyz.com</u>. Your feedback about this Guide will help us to improve it with future revisions.

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This is the V1.0 (Sep, 2023) revision of the X1 GNSS Receiver User Guide. It can not be copied or translated into any language without the written permission of SingularXYZ.

The receiver can withstand the rough treatment that typically occurs in the field. However, the receiver is high-precision electronic equipment and should be treated with reasonable care.

FCC Notice

SingularXYZ[®] X1 GNSS receivers comply with the limits for a Class B digital device, pursuant to the Part 15 of the FCC rules when it is used in the Portable Mode.

Operation is subject to the following two conditions:

(1) This device may not cause harmful interference;

(2) It must accept any interference received, including interference that may cause undesired operation.

Technical Assistant

If you have any question and can't find the answer in this manual, please contact your local dealer from which you purchased the X1 receiver. Alternatively, request technical support from SingularXYZ.

Website: <u>www.singularxyz.com</u> or technical support email: <u>support@singularxyz.com</u>. Your feedback about this Guide will help us to improve it with future revisions.

Safety Information

Before using the receiver, please make sure that you have read and understood this User Guide, as well as the safety requirements.

- Connect your devices strictly based on this User Guide
- Install the GNSS receiver in a location that minimizes vibration and moisture

- Avoid falling to ground, or colliding with other items
- Do not rotate 7-pin Lemo port
- Do not cover the radio, keep a sound ventilation environment
- To reduce radiation, please keep above 2 meters away from the radio station
- Take lighting protection measures when installing antennas
- Change the cable if damaged

Use and Care

The receiver can withstand the rough treatment that typically occurs in the field. However, the receiver is high-precision electronic equipment and should be treated with reasonable care.

Warning and Caution

An absence of specific alerts does not mean that there are no safety risks involved. A Warning or Caution information is intended to minimize the risk of personal injury and/or damage to the equipment.

WARNING- A Warning alerts you to a potential risk of serious injury to your person and/or damage to the equipment, because of improper operations or wrong settings of the equipment.CAUTION- A Caution alerts you to a possible risk of damage to the equipment and/or data loss.

Warranty Notice

SingularXYZ does not warranty devices damage because of force majeure (lighting, high voltage or collision).

SingularXYZ does not warranty the disassembled devices.

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Chapter 1 Introduction

The SingularXYZ X1-Series (hereinafter X1) GNSS Receiver User Guide is aimed to help you get familiar with the X1 receiver and start your project effectively. We highly recommend you to read this manual before surveying, even you have used other GNSS RTK receivers before.

1.1 About the Receiver

With high precision GNSS module inside, X1 GNSS receiver can be applied in RTK mode with all GNSS constellations. X1 receiver has ultra-small size and strong antiinterference ability to make it possible to work even in harsh environments. It is the ideal RTK/GNSS product for surveyors.

Currently, there are three types of receivers in the X1 series: X1 Lite, X1 Standard, and X1Pro, and the following are the features that have been reduced or added in comparison to X1.

X1 Lite: Compared to the X1, the X1 Lite receiver does not have a SIM card slot, which means it does not support Device Internet mode.

X1 Pro: Compared to the X1, the X1 Pro receiver is equipped with color LED display, which clearly shows the receiver operating status.

1.2 Receiver Features

The SingularXYZ X1 GNSS Receiver key features:

- Ultra small and super light
- Size: Φ133.5 mm × 67 mm
- Weight: 870 g
- 1408 channels of simultaneously tracked satellite signals
- Fast charging via Type-C interface
- Cable-free Bluetooth wireless technology
- LCD Display with easy configure functions
- IP68 waterproof
- Full base/rover interoperability
- Integrated IMU sensor
- Long distance range radio module
- Integrated 4G module (exclude X1 Lite), support Ntrip and TCP protocols

1.3 X1-Series Packing List

This section provides overall X1 receiver packing list, including basic supplies and customized kits based on your requirements.

10 H	 -		4.46	-8
24.1	 -	-		-
-				ы.

1-Series GNSIS Receiver +1	Type-C to Type-C UII8 Cable ×1	Transport Case +1
	- Î Î	
		1
Ballery Charger +1	Whip Antienus =1	
	/	

Chapter 2 User Interface

This chapter provides general information on environmental requirements, setup, power supply and connection of the X1 receiver.

2.1 Environmental requirements

To keep the receiver with a reliable performance, it is better to use the receiver in safe environmental conditions:

- Operating temperature: -40°C to +65°C
- Storage temperature: -55°C to +85°C
- Out of corrosive fluids and gases
- With a clear view of sky

2.2 Front panel

Receiver front panel contains 4 indicator LEDs, Function button and Power button.



Indicators		Description		
He,	Satellite Tracking Indicator	Flash N times every 5s N: Number of tracking satellites		
Fn	Static & Network Indicator	Yellow light flashes: recording static data		
m	Function Button	Press twice in succession to start/stop static data recording		
¢1.0	Correction Data Indicator	Flash when TX/RX correction data		
0	Power Indicator	Red light on: receiver on Red light flashes: power < 10% Green light flashes: charging Green light on: fully charged		
U	Power Button	Long press to turn on/off the receiver		

2.3 Lower housing

Receiver lower housing contains a serial port, USB port, UHF radio antenna connector and one sim card slot.



2.4 Power supply

2.4.1 Battery

The receiver is equipped with internal batteries.

- 6700 mAh, over 20 hours working time
- Fast charge of 2.5 hours charging time (when using a 100W fast charging charger)

2.4.2 External Power Supply

The receiver is connected to an external power supply through a lemo to RS232 cable, and make sure that the red alligator clip is connected to the positive of external power supply, black one to negative. Over- voltage function cannot protect your X1 receiver if reverse connection. (These two cables are optional. If needed, please communicate with the sales to confirm before placing an order.)



Tip: The power consumption will be increasing if the base station transmits correction data through internal UHF in the RTK mode; therefore, we strongly suggest using external power (9-28 volt DC) for the base station.

Chapter 3 Static Survey

This chapter describes how to conduct static survey through X1 receiver and SingularXYZ Converter software. For static survey, X1 supports 2 data formats: XYZ, Rinex. SingularXYZ binary format(*.XYZ) is a raw observation data format and you can convert it to RINEX format via SingularXYZ Converter Software. (Contact SingularXYZ support team for the tool).

If you need post-processing software, please contact the support email at <support@singularxyz.com> for assistance.

3.1 Static Data Collection

Static survey is mainly used for the control survey. To reach millimeter accuracy, follow as below:

- At least 3 GNSS receivers are required to form a stable triangulation network.
- It is better to set Data Log Session as manual on the known point.
- Power off the receiver before moving to other observation site.
- For the convenience of post-process static observation raw data, record the station name, receiver SN, antenna height, start and end time for each observation site.

Tip: You can start recording static data in the front panel by double-pressing the function button, it's convenient for you.

The following steps give an example of static survey.

 Go to *Device* >> *Static and collect points*. Choose the Record mode, there are two record modes and they can record static data at the same time.

	LE H5.783 (0 V6.917 20 X1	N28 ■ ●
17	7	1
Communica- tion	Rover	Base
	1	-
Device Information	Static and collect points	Com Settings
	10	-
Device Activation	Inspection accuracy	Device Settings
Project	Surve	y Tools

2. Option Settings interface : Input Record name and Point name. Set the Collection Interval, Observation Time and Data Format.

÷	SINGLE Age0	H5.411 V:6.753	22/27	-
Record mod	e		Record1	5
Options Ser	tings			
Record nam			RE	51
Point name			xt 🤉	ĸ
Collection In	terval		15	0
Observation	Time		1 hour	×.
Data Format	8		XYZ	2
Loop Record	l.		a	0
Auto Record	Static Data		0	e
Record Space	e		30	00

3. Turn on/off the *Loop Record* according to you needs. If this option is opened, receiver will delete the earliest recorded data to keep recording when the record space is full.

÷	SINGLE Age0	H5.411 V:6.753	22/27
Record mo	de		Record1 >
Options Se	ntings		
Record nar	ne		REC1
Point name			$xi\times$
Collection	Interval		15)
Observatio	n Time		1 hour >
Data Form	at ::		xyz >
Loop Reco	rđ		0
Auto Reco	nd Static Data		Op
Record Sp	sce		3000

4. Turn on/off the *Auto Record Static* according to you needs. If this option is opened, the receiver automatically records static data after it is power on.

÷	SINGLE Age0	H5.411 V:6.753	22/27
Record mo	de		Record1 >
Options Se	rtings		
Record ner	net		REC1
Point name			$_{\rm xi}\times$
Collection I	nterval		18)
Observation	n Time		1 hour >
Data Forma	t,:		xyz >
Loop Recor	d		=0
Auto Recor	d Static Data		Op
Record Spa	ce		3000

5. Set the *Record Space* in the end(unit:MB). It will limit the amount of data that receiver record.

÷	SINGLE H5. Age0 V:63	111 🚴 🧂
Record m	ode	Record1 >
Options S	ettings	
Record na	ltse	REC1
Point nam	e	$\times i x$
Collection	Interval	18)
Observation	on Time	1 hour >
Data Form	at	xyz >
Loop Rec	brd	=0
Auto Reco	and Static Data	OP
Record Sp	ace	3000

6. Click **start** to static survey.

÷	SINGLE Age0	H5.411 V:6.753	22/27
Record m	ode		Record1 >
Options S	Settings		
Record n	erte		REC1
Point nam	ne		$_{\rm xi}\times$
Collection	n Interval		18)
Observat	ion Time		1 hour >
Data Form	nat		xyz >
Loop Rec	ord		=0
Auto Rec	Auto Record Static Data		Op
Record S	pace		3000

3.2 Static Data Download

The raw observation data is saved in internal memory of X1 receiver, when connected with PC via TYPE-C cable, the X1 receiver can work as a USB Flash Disk – SingularXYZ_DISK, which means you can copy the static data to PC directly.

U 盘 (E) > 1-REC1 > 2023293

名称	修改日期	英型	大小
1823E00052930339.XYZ	10/20/2023 3:43 AM	XYZ 文件	690 KB
1823E00052930344.XYZ	10/20/2023 3:45 AM	XYZ 文件	165 KB
1823E00052930345.XYZ	10/20/2023 3:45 AM	XVZ 文件	147 KB
1823E00052930547.XYZ	10/20/2023 5:59 AM	XYZ 文件	2,460 KB
1823E00052930600.XVZ	10/20/2023 6:28 AM	XVZ 文件	5,183 KB

In addition, you can download the static data via WebUI, connect the WiFi of the X1 receiver and log in **192.168.10.12** (Username: **admin**, Passwords: **admin**) Go to **Work management** >> **File Download** to download the static data.

Go to Work management >> File Download, select the corresponding record name, file type and date to filter and download the static data.



3.3 **RINEX Convert**

After copy raw observation data to PC, you can convert the data from SingularXYZ binary format (*.XYZ) to Rinex in SingularXYZ Converter software. The following steps give an example of Rinex convert.

- 1. Start SingularXYZ Converter software;
- 2. Set the output path and select to import the binary file;

SingularXYZ Conversion Tool				- 0	×
OutputPath				📔 En	
FileName	Size	Transition state	Version	Options	
	N	o Data			
		1			
Select File			Convert		

3. After import the binary file, click set then input the marker name and choose the measure type of antenna height, and the antenna type is automatically identified as SITE 1 for X1 receiver;

MessageID	Amount	MarkName	136
108	50	AntType	SITX1
107	12	Measure	Phase Center Height
109	10		
12	252	Satellite	GPS
106	20		BDS
			GALILEO

4. Click *convert* to start convert XYZ to Rinex, and the Rinex files will be output to the output file path.

Singula	arXYZ Conversion Tool				- 🗆 X
OutputPath	E:\output				📒 🗈 🌆
	FileName	Size	Transition state	Version	Options
1	12010929.XYZ	2.07M	0	3.02 × set	remove

elect File

Conver

NOTE

The output path of the conversion software and the storage path of the files to be converted can only contain English letters and numbers.

Chapter 4 RTK Workflow

This chapter introduces how to conduct RTK Survey with SingularPad Software. SingularPad is professional Android-based surveying software developed by SingularXYZ team. SingularPad is fully functional as a field surveying software, equipped with complete work modes and necessary functions for surveyors.

4.1 Installation of SingularPad

SingularPad has been pre-installed on SingularXYZ data collector before shipping, and you can use one month for free, if you want to download on your device, please connect us.

4.2 Create a New Project

Click **Project Manager**, click the **New** button in the lower corner if the screen and input project name, set coordinates systems parameters and click **OK** to save the project.



Besic Information	garameters	Basic Information	parantalista
Project Path gran Sha	age/TingularPad/Project	Coordinate systems parar type	perameters
Project Name	X1	Name	:=
Operator	SingularXYZ	Ellipsoid Parameter	
Distance Unit	Meter 3	WGS84 Semimajor axis:637 1/	1298.257223563
Angle format	dd*mmiss.sess* >	ITRF Parameter	
Lat/Lon format	dd'mmias.sess" 🗧	Not Set	
Default 1st Point Name	e P11.5	Projections Paramister	
Notes		UTM Central Meridian	E123'00'00'
Date Greated	2023-10-20 03 26 22	Dotum Parameter	
Cancel	OK	Previous	ОК
NOTE			
and the second second	encollecto notore foi	most requiring You can	find the coordinate

In **Project Manager interface**, you can click previous projects in the Project List to **remove** or **open** it. If you have added one project, you can click the project name in the main interface to check the current project details, including Project Name, Project Path and Coordinate systems parameters. And you can edit it.

+ Project Manager		
Current Project		
X1 Program Disasperities	ulartu. 2022 10 22 06 46.23	
Project Livit	Input query keyword	
St Comment VZ		
	00HH	

If you can not find the datum you want in the list, follow instructions below to add one: select ellipsoid para, projection para, datum para, and input horizon adjustment, vertical adjustment and local offsets based on your request. Save and apply it. Meanwhile you can share the coordinate system with your workmates.

The following steps give an example of how to find the predefined coordinate system you need in SingularPad software.

Click the button located after *Name* in Coordinate System Parameters interface.

← Coordina Paramete	te Syster	m
Coordinate Syste	т Туре	Local Bystem >
Name		NUUT 🔢
Ellipsoid Parame	ner	
CGCS2000 Semimajor Auto	6 1/1/29	8.257222101
ITRF Convention		
None		
Projection Paran	winter .	
UTM Central Meridian		E123*00'00' 2
Datum Paramete	er.	
None		3
Horizontal Adjus	RIMME	
Share	lans As	OK-

In the Coordinate System Favorites interface, click the *Template* below to enter the Predefined Projections interface.



Click *Country* to select the country name or enter a keyword after *Search* to find it.

Predefined Projections		Predefined Projections	
Country	AII >	Country All >	
Sear Country	nput	Search CASS X	
Data All		Data Content	
GRI ANGOLA	0°E	Cass WGS_1984 USA COUNTY IN	
NAD		Cass/North	
GR! AUSTRALIA Trai	0°E	Cass/North Ellipsoid USA COUNTY MN Lambert_Conformal_Contc_2SP	
NAD AUSTRIA GRI		Cass/South Cass/South Elipsoid USA COUNTY MN	
Hot BELGIUM		Lambert_Conformal_Conic_2SP	
RE BOSNIA		GDM2000-Cassini-Soldner Geocentric-Johor	
Trai pp 7/1 NADR3/Alaska (Zone 3)	0°E	Everest 1964 MALAYSIA Cassini, Soldner	
GRS 1980 USA		GDM2000-Cassini-Soldner	
Transverse_Mercator 214*00'00.00000*E		Geocentric-Kedah_perlis	
NADR3/Alaska (Zone 4)		Evereut 1984 MALAYSIA	

After finding the required coordinate system, click *Apply* to add it to coordinate system parameters, click *OK* to apply it to the current project.

+ Predefined Projections	Coordinate System Parameters		
Country AUSTRALIA >	Coordinate System Type Local Byown 2		
Search Input.	Name AGD56-ACT/AMG zone 48 E10		
Outa Content	Ellipsoid Panamitter		
AGDO	Australian National Spheroid Semimajor Axia 5. 1/f.298.25		
AGD66-ACT/AMG zone 49 E108-114	ITHE Conversion		
Australian National., AUSTRAUA Transverse, Mercator 111'00/00.00000'E	None		
AGD66-ACT/AMG zone 50 E114-120	Projection Parameter		
Australian National AUSTRALIA Transverse, Mercator 117*00'00.00000'E	UTM(Southern Hernisphere) Central Meridian E105'00'00"		
AGD66-ACT/AMG zone 51 E120-126 Australian National. AUSTRALIA	Datum Parameter		
Transverse, Mercator 123'00'00.00000'E	Helmert		
AGD66-ACT/AMG zone 52 E126-132	ΔX(m) -129.193 Δα(s) -0.246		
Australian National AUSTRALIA	ΔY(m) -41.212 Δβ(s) -0.374		
Transverse_Mercator 129'00'00.00000'E AGD66-ACT/AMG zone 53 E132-138	Share Share An OK		

If you can't find what you need in Predefined Projections, you can click **Add** or **Import** to create new coordinate system.

Coordinate System Parameters		← Coordinate System Favorites
Coordinate System Type L	ucal System >	Outs Content
Nome AGD66-ACT/AMG zone 48 E11		AGD66-ACT/AMG zone 48 E102-108 Australian National. AUSTRALIA UTM(Southern Hem., 105'00'00.00000'E
Australian National Sphe Semmajor Astr.6. 1/1296.2	roid	
ITHE Convenuon		
None	2	
Projection Parameter		
UTM(Southern Hernisph Central Meridian E1	ere) 🤍 🔊	
Chattum Parameter		
Helmert ΔX(m) -129 193 Δu(s) ΔY(m) -41.212 ΔB(s)	0.246	
Share Save As	öκ?	Aut import Download Template

4.3 **Device connection**

4.3.1 NFC connection

Equipped with an NFC chip, users can easily connect the X1 receiver and the data collector with just one touch, as shown in the figure below.



4.3.2 Bluetooth connection

After creating a new project, switch to **Device** interface, click **Communication**. You can connect SingularPad with SingularXYZ X1 GNSS receivers.

Communicatio	Rover	Rase
1	12	-
Static Record	impection Accuracy	COM Settinge
		
Device Activation	Device Information	
	2 2	

Select the corresponding parameters according to the following requirements

Device Type: GNSS

Device Manufacturer: SingularXYZ

Mode Type: RTK(X1)

Connection Type: Bluetooth

	on
Device Type	GNGS >
Device Manufacturer	Singular/VZ >
Model Type	60%(Q(2) ->
Connection Type	Buttern 2
2124R0056	54465084240mt ³
۰ ،	

Make sure device Bluetooth turned on, click below Currently Paired Device to find SN number of your X1 receiver. Click **Connect**.

← Communication		← Communicatio	ń
Device Type	GN55.)	Device Type	965)
Device Manufacturer	SingularXVZ ()	Device Manufacturer	Signature 3
Model Type	RTK(KI) >	Model Type	#76(D0)-2
Connection Type	Bluetooth 3	Connection Type	Blanceth 3
Currently Paired Device		Currently Paired Devic	ž.
5445 5445	85421862	301 2124R0000	64.6598.6219.62
Correct		Frebag	Stop

After connecting X1 receiver, you can check the information of the receiver (like firmware version) in *Device Information*.



Tip: If you are failed to connect with receiver through SingularPad, you can just follow prompt info to go into the device Bluetooth setting interface to make sure Bluetooth paired successfully. Sometimes you need forget the device Bluetooth, restart the receiver or SingularPad Software and get pair again.

4.4 Quick setup X1 receiver

4.4.1 Start Base Station by SingularPad

If you've purchased 2 units of X1 GNSS receiver, please select one X1 as base and the other as rover. During configuration, you need to connect your PDA device or data collector to the base and rover respectively. When work as a Base station, SingularPad supports transmit the correction data in Internal Radio mode and Device Internet mode.

Internal Radio: This mode uses internal radio to transmit the correction data from Base to Rover. You need to set Base and Rover with same protocol and frequency.

Tip: X1-Series GNSS receiver has two radio versions, U and LU version. U version radio supports many radio protocols whether base or rover, but data transmission distance can only reach 3-5 kilometers under ideal environment; LU version radio only supports CSS radio protocol when set as base, and also supports many radio protocols including CSS radio when set as rover, but data transmission distance can reach 10-15 kilometers under ideal environment. Please contact the sales to confirm which radio version to purchase.

O TIP

Where to Set Up the Base Station?

- Ideal Environment:
 Clear outdoor sky view, free from obstructions
- Place GPS and radio antennas as high as possible to reduce signal interfer-
- ence and increase range

Avoid:

- Obstacles: buildings, vehicles, towers, trees, etc.
- Interference: high-power radiat, TV, cellular towers, power lines or electrical
- facilities

The following steps give an example of internal radio transmission.

NOTE
 Set Internal Radio Work Mode: Connect the whip antenna to both your base station and rover.

1. Go to *Device* >> *Base*. Set *Base ID* and choose the *Diff Mode* firstly.



2. Click Base Startup Mode to select the base startup way.

← Base Mode Settings	← Base Mode Settings
Base ID:123 Diff Format/HTCM32 > Rase Startup Mode Single Point 3	General Parameters E
Rube Disable >> Outsine Settings	Diss Base Startup Mode
Datalink Device Internet 2 Connecting Mode NTRIP IP: Server Port.6050 2 Password:*****	Data Assigned Base Coordinates et
Base Access Point Input	Base Access Point Input
Share Save Slart Bana	State Care State

Single Point: Start the base station at unknown coordinates.
Assigned Base Coordinates: Start the base station at known coordinates, and you need to enter the latitude, longitude and the height.
Use Current Coordinates: Automatically start the base station at current

coordinates.

NOTE

Please setup the base station at a known point. Select Base Startup Mode as Assigned Base Coordinates and input the known point coordinates. Make sure the current coordinates of the instrument is within 50 meters of the known point coordinates. Otherwise, you will need to conduct 3.3 Calibrate Point after or before surveying.

3. Set *Data Link* as *Internal Radio*. Set parameter settings, Channel, Frequency, Protocol, Baud Rate and Power.

Channel	6
Frequency	460.0
Protocol	TRMTALK
Baud Rate	9600
Power	14mm

4. When start Base succeed, it will show as below in SingularPad.

Device Internet: This mode uses 4G(internet data) to transmit the correction data from Base to Rover. You need to insert a SIM card to Base, set the Base to log on the server (with static IP address), and the Rover receives the correction data by Ntrip protocol.

Tip: Compared to the X1 and X1 Pro, the X1 Lite receiver does not have a SIM card slot, which means it does not support Device Internet mode. When inserting the SIM card, be careful not to insert it upside down, otherwise the card slot may be damaged.

The following steps give an example of device internet transmission.

- 1. Insert a SIM card to the X1 receiver and then turn on the receiver.
- 2. Go to *Device* >> *Base*. Set Base ID and choose the Diff Mode firstly.

SINGI Aqid	E H.2.191 V/4.729 2	NA7 🔒 🛞	← Base Setup Par	а
	X1		Base ID	123 ×
1	7	1	Diff Mode	RTCM3.2 >
Communica- tion	Rover	Base		
12	-	1		
Inspection accuracy	Device Information	Static and collect points		
-		+		
Com Settings	Device Activation	More		
-	- 12			
Project	nice Surve	ry Tools		

3. Set *Start up Mode*. And choose *Device Internet* in *Data Link*.

4	Base mode setting	15		← 1	Base m	node settings	
Base Base Start (Sertup Para ID:123 Diff M Jp Mode	ode:RTCM3.2 Single Puert	N N	Base S Base Start U	Setup Pa ID:123 Jp Mode	Diff Mode	s:RTCM3.2 >
Dutal Data Conr IP:4. Pass Base	Start Up Mode Single Point Input Base Coordin Use Current Coordi	nates nates 000	3	Datal Data Cons IP:4; Pase	Data I Interna Device Interna	Link al Radio e Internet al Radio+Device et	net >
Sh	are Collection	Set Base		Sha	are	Collection	Set Base Startup

 Parameter Settings. Choose NTRIP in Connect Mode. Input the server IP, Port, Password in the CORS Settings. APN Settings (Access point number, acquire from the mobile service provider). Input Name, User and Password.

← Parameter Setti	ngs
Device Internet	
Connect Mode	NTRIP >
CORS Settings	
IP	47.103.96.216 ×
Port	8080
Password	©
APN Settings	
Name	3gnet
User	
Password	0
ок	

5. Set the *Base access point* in the end.

🗲 Base m	ode settings	
Base Setup Pa	ira	=
Base ID:123	Diff Mod	e:RTCM3.2 >
Start Up Mode		Single Point
Datalink Settin	igs	
Data Link		Device Internet 🗦
Connect Mode IP:47.103.96.2 Password:****	::NTRIP 16 Server P	ort:8080 >
Base access p	oint	1823E0005
		Set Base
Share	Collection	

6. When start Base succeed, it will show as below in SingularPad.

Tip: X1 receiver does not support hot swap, please shut down the X1 receiver then insert the SIM card. If you turn on the receiver and insert the SIM card, please reboot the receiver.

4.4.2 Start Rover Station by SingularPad

When work as a Rover station, SingularPad supports receive the correction data in Internal Radio mode, Device Internet mode and Phone Internet Mode. Internal Radio: Select the same protocol and frequency with the Base receiver, and then the receiver status will turn single to be fixed. The following steps show an example of internal radio.

The following steps give an example of internal radio transmission.

- SINGLE 86 ← Rover mode settings **(f)** 26/47 Age0 **Datalink Settings** XI Internal Radio Data Link Channel:6 Frequency:460.05 Communica Rover Base Protocol:TRIMTALK Baud Rate:9600 tion Base Coordinates Change Alert Inspection Device Static and accuracy Information collect points More Com Settings Device Activation Tools Same
- 1. Go to **Device** >> **Rover**. Set **Data Link** as **Internal Radio**.

2. *Parameter Settings*. Set Channel, Frequency and Protocol same with the Base.

← Parameter Settings	
Internal Radio	
Channel	6 >
Frequency	460.05
Protocol	TRIMTALK >
Baud Rate	9600 >
ок	

3. **Base Coordinates Change Alert**: SingularPad will alert when you connect with different base station. When the Base station is VRS, please don't open this.



4. Click *Apply* to start the Rover mode. When start Rover succeed, it will show as below in SingularPad.

Device Internet: Same with start Base station, you need to insert a SIM card to Rover,

set the server IP and port, and receives the correction data by Ntrip protocol. The following steps give an example of device internet transmission.

1. Go to Device >> Rover. Set Data Link as Device Internet.

SINGI Age0	E H2.191	80 🔒 🖉	+ Rover mode	e settings	
	X1		Datalink Settings		
		()	Data Link	Devic	e Internet >
Communica- tion	Rover	Base	Connect Mode:NTR IP:47.103.96.216 User:SingularXYZ	Server Port:8 Password:**	080 >
10	-	1	MountPoint Settin	gs	Get
Inspection	Device	Static and	MountPoint		Office >
accuracy	Information	collect points	Phone internet acce	HSS	0
		+	Base Coordinates C please close)	hange Alert(VR	s co
Com Settings	Device Activation	More	Radio relay		O
		8	Share Co	allection	Apply

 Parameter Settings. Choose NTRIP in Connect Mode. Input the server IP, Port, User and Password in the CORS Settings. APN Settings. Input Name, User and Password.

← Parameter Settin	ngs
Device Internet	
Connect Mode	NTRIP >
CORS Settings	:=
IP	47.103.96.216 🗙
Port	8080
Password	©
APN Settings	E
Name	3gnet
User	
Password	0
ок	

 Click *Get* button on the right and "Get MountPoint succeeded" will be displayed below. Then choose the mountpoint.

← Rover mode	e settings	
Detailink Settings		
Data Link	Device	Internet. >
Connect Mode:NTR	9P	
IP:47.103.96.216	Server Port80	80 >
User:SingularXYZ	Pasaword:****	
MountPoint Setting	20	Get
MountPoint		2
Phone internet acce	55	=0
Base Coordinates C please close)	hange Alert(VRS	=0
Radio relay		OD
Get Mount	Point succeeded!	-taphy

4. **Phone internet access**: Rover station will access the mountpoint via phone internet, you need to make sure controller have access to Internet. If don't open this, rover station will access the moutpoint via device internet.

Annual Contraining		
Data Link	Device Intern	et)
Connect Mode:NTR	1P	
IP:47.103.96.216	Server Port 8080	- 3
User:SingularXYZ	Password:*****	
MountPoint Setting	js G	et
MountPoint	Offe	e 7
Phone internet acce	ss	0
Base Coordinates Cl please close)	hange Alert(VRS	0
Radio relay	C	Dis

5. **Base Coordinates Change Alert**: SingularPad will alert when you connect with different base station. When the Base station is VRS, please don't open this.

← Rover mode	settings	
Detailink Settings		
Data Link	Device	internet
Connect Mode:NTR	ιP	
IP:47.103.96.216	Server Port 80	000
User:SingularXYZ	Password:***	***
MountPoint Setting	js .	Get
MountPoint		Office 2
Phone internet acce	ss .	=0
Base Coordinates Cl please close)	hange Alert(VRS	- C
Radio relay		0
Thurs - Co	Westion	

6. Click *Apply* to start the Rover mode. When start Rover succeed, it will show as below in SingularPad.

Phone Internet: This mode uses the phone internet to transmit the correction data from Base to Rover. Please make sure the PDA device is in good network conditions, such as 4G, WiFi or hot spot.

The following steps give an example of device internet transmission.

1. Go to **Device** >> **Rover**. Set **Data Link** as **Phone Internet**.

Data Link	Pho	ne Internet
Connect Mode:NTR	P	
IP:47.103.96.216	Server Port	8080
User:SingularXYZ	Password.**	
AduntPoint Setting	id.	Get
MountPoint		
becaive data		
\bigcirc	► s	tart

2. Set *Connect Mode*, for X1 receiver supports NTRIP and TCP Client.

CORS Settings. Input the server IP, Port, User and Password in the CORS Settings.

← Parameter Setti	ings
Phone Internet	
Connect Mode	NTRIP >
CORS Settings	
IP	47.103.96.216 ×
Port	8080
User	SingularXYZ
Password	©
ок	

NOTE The IP & port in the picture is only for example, please enter your local CORS account instead. You can purchase a third party RTK corrections service account in your local area to obtain an RTK FDK solution.

3. Click *Get* button on the right to get the mountpoint list and choose the mountpoint.

 Rover mode 	e settings		
annunk samuda			
Data Link	Phone	a internet	<i>(</i>
Connect Mode:NTF IP:47.103.96.216 User:SingularXYZ	Server Port 80 Password.***	×**	NOTE The mount point "Office" in the figure is an
lountPoint Settin	15	Get	example. Please find out the appropriate mount point via the website of your local NTRIP/CORS
MountPoint		Office >	provider. Make sure that the baseline doesn't
beceive data			C. C
\bigcirc	▶ Sta	art	
Auto connect to net	work	=0	
Share Co		Apply	

4. Click **Start** button on the right to receive data from Base station. Then you can see the rover station is receiving data.

← Rover mode	settings		← Rover mode	settings	
Detalink Settings			Datalink Settings		
Data Link	Phone Internet	e s	Data Link		Phone Immed. 3
Connect Mode:NTR IP:47.103.96.216 User:SingularXYZ	p Server Port:8080 Password:*****	5	Connect Mode:NTRI IP:47.103.96.216 User:SingularXYZ	P Server P Passwor	ort:8080 d:*****
MountPoint Sitting	G	et	MountPoint Setting	s .	Getti
MountPoint	Offic	a. 2	MountPoint		office >
Receive data	▶ Start]	Receive data	П	Stop
Auto connect to netw	vork C	0	Auto connect to netw	varik	
Sherry Co	Heation (Appl)		Share Col		Apply

5. **Auto connect to network**: When this option is opened, SingularPad will connect to network automatically so that user don't need to click start to connect network.

Connect Mode:NTR	IP.
IP:47.103.96.216	Server Port:8080
User:SingularXYZ	Password:*****
MountPoint Setting	ge () . Get
MountPoint	office
Receive stata	
1227B	Stop
Auto connect to net	work 🔍
Base Coordinates Cl please close)	hange Alert(VRS

6. **Base Coordinates Change Alert**: SingularPad will alert when you connect with different base station. When the Base station is VRS, please don't open this.

← Rover mode	e settings	
Connect Mode:NTR	3P	
IP:47.103.96.216	Server Por	1:8080
User:SingularXYZ	Password	*****
MountPoint Setting	16	Get
MountPoint		office >
Receive data		
12278	П	Stop
Auto connect to net	work	
Base Coordinates C please close)	hange Alert(VRS CO
Share Co		

7. Click *Apply* to start the rover mode. After completing the configuration, please check the RTK status in the top status bar. Once the status changes to "FIXED" and the differential delay "age" is within the range of 1-2 seconds, you have obtained reliable centimeter-level RTK positioning.

FIXE April	D H5011 V0.021 3 X1	\$**] ⊕
-	T	
Communica- tion	Rover	Base
12	-	栗
inspection accuracy	Device Information	Static and collect points
	-	-
Com Settings	Device Activation	Device Settings
Project	en le	ty Toole

Chapter 5 RTK Survey-field Data collect

This section describes the basic survey functions of SingularPad, including Point
Survey, Detail Survey, Control Point Survey, Point Stakeout, CAD Mapping and etc.
5.1 SingularPad Top Status Bar Introduction

After completing your X1 RTK setup, check current RTK solution status at the top of the SingularPad software.



RTK solution status	Description
FIXED	E1 is receiving RTK corrections stably and obtaining a Fixed RTK solution with centime- ter-level accuracy.
SINGLE	Single-point satellite positioning without receiving RTK correction data. The accuracy is around meter-level.
DGNSS	E1 received corrections from the base/CORS, but it needs more time to calculate due to environmental interference or correction data quality. The accuracy is around decimeter-level.
FLOAT	E1 receives corrections from the base/CORS, but due to obstructions or magnetic field interference the signal reception is not very stable and the accuracy is sub-meter level.



The satellite icon shows calculated satellites number/tracked satellites number. You can click it to check satellite map and more information.

Age3

Age means the time since the last differential data was received.

When connecting to a CORS account for measurement work, please ensure the "age" is within the range of 1-2.

When using the radio mode for measurement work, please ensure the "age" is within the range of 2-5.

A high "age" will result in poor measurement point accuracy.



There are HRMS and VRMS on the top of the interface, click it you can check more details.

5.2 Point Survey

Before RTK survey, please make sure that receiver is receiving the correction data and get a fixed solution, age means the time since the last differential data was received, please check if this number keeps growing.



There are HRMS and VRMS on the top of the interface, click it you can check more details.

FIXE	D Hast	🇞 🔒 🕀	÷	Posi	tion Inform	mation	
	X1		Den	af.	Base	SAT Info	SAT Map
-		(B)	Solu	rtion S	tatus FI)	KED (GB+R	7+022+64/46)
*SP7	1	NV.	В.	31'07	58.5541'N	N 14	4230337.791
Communica- tion	Rover	Base	1.5	121*17	'22.9152'E	ε)	6759006.535
1.00	-	-	н		17.597	Elev	17.597
		不	Spee	be	0.000	Heading	0.00
Inspection accuracy	Device Information	Static and collect points	PDO	ρ	0.800	HRMS	0.011
1		·	HDO	p	0.700	VRMS	0.021
-	1	-	VDO	P	0.700	AGE	1
Com Settings	Device	Device Settings	UTC	time	2	023-10-24	07:18:18.000
	Activation		Loca	d time	2	023-10-24	07:18:18.000
	-		Dist	snice to	Ref		39.091m
Project	Surv	ey Tools					

The satellites number is on the top of the interface, click it you can check the satellite map and information.



In the Survey interface, click **Point Survey** and enter point name, code and antenna





Note:

Our software supports 4 antenna measuring types



Pole Height: Typically, select the Antenna Measuring Type as Pole Height and enter the height of your centering pole.

In the floating window of the survey interface, you can see the display information. The default display information is NEH and Base distance, and click the floating

window you can set them as you need. You can also click to enter the display information settings interface and select the information you need to display. Except default display information, SingularPad supports Longitude, Latitude and Altitude etc.

	n1 🇞 🔒	← Settings	i .	
14230338.178 H:17.0	637 distance:38.985	Settings	Electrical Justice	Tool Bar
	-	Options		
	ite	Long		Lat
		Altitude		Ant. H
		Forward azim	wth	Speed
		Time		oint dist.
		Pt. H dist	PL.E	levation diff.
GAT		oN		σE
	0	PDOP		HDOP
1 P = 6	Č.	VDOP	Incli	nation Angle
ame Pt1 × Code		Projection Ar	ngle	
Intenna Height	1.8+0.068m >	Backspace	Default	ок

• Click Click Click Click Click Composition Click Clic

	Display Map
	none
	Google Map(Standard Map)
10.4	Google Map(Satellite Map)
1	OpenStreetMap
C	WMS Map Config
-	Map calibration
C III	6" THE CO 20
Plame	e Pt1 X Code
Ante	nna Height 1.8+0.068m
🏅 to jump to ma	an center
to jump to me	
	CAL DIVER HOUSE &
(FIXED H0011 🇞
← N14	FIXED +10.011 & Age1 V.0.021 42/46 2 230347.369 H:17,677
← N:14 E:675	FIXED H0.011 & Age1 V0.021 42/46 and 2200347.369 H:17.677 59010.444 Base distance 43.4
← N:14 E:675	FIXED +10.011 Age1 V.0.021 42/46 230347.369 H:17,677 59010.444 Base distance 43.4
← №14 £675	FIXED H0.011 & Age1 V0.021 43/46 230347.369 H:17.677 59010.444 Base distance 43.47
← N:14 E:675	FIXED +10.011 Age1 V.0.021 42/46 230347.369 H:17,677 59010.444 Base distance 43.4
← N:14 E:675	FIXED +10.011 Age1 v.0.021 42/46 230347.369 H:17.677 59010.444 Base distance 43.43
← №14 £675	FIXED +10.011 Aget v.0.021 42/46 230347.369 H:17,677 59010.444 Base distance 43.43
← N:14 E:675	FIXED +10.011 Age1 V.0.021 42/46 230347.369 H:17.677 59010.444 Base distance 43.4
← N:14 E:675	FIXED #10.011 Age1 V.0.021 42/46 230347.369 H:17,677 59010.444 Base distance 43.43
← N:14 £:675	FIXED +10.011 Aget V0.021 42/46 230347.369 H:17,677 59010.444 Base distance 43.4
← N:14 E:675	FIXED +10.011 Age1 V.0.021 42/46 230347.369 H:17.677 59010.444 Base distance 43.4 G
← N:14 £:675	FIXED #10.011 Age1 V.0.021 42/46 230347.369 H:17.677 59010.444 Base distance 43.43
← N:14) E:675	FIXED #10.011 Age1 V.0.021 42/46 230347.369 H:17.677 59010.444 Base distance 43.43
← N-14/ E-671	FIXED +10.011 Age1 V.0.021 42/46 230347,369 H:17,677 59010.444 Base distance 43.4
 ↓ №140 №	FIXED #10.011 Age1 V.0.021 42/46 230347.369 H:17.677 59010.444 Base distance 43.43
► N:140 E:675	FIXED HUDTI Age1 V.0021 42/46 230347.369 H:17.677 59010.444 Base distance 43.43
 ↓ №144 №1675 №144 №1675 №144 <li< td=""><td>FIXED 40.011 Age1 V.0.021 42/46 230347.369 H.17.677 59010.444 Base distance 43.43</td></li<>	FIXED 40.011 Age1 V.0.021 42/46 230347.369 H.17.677 59010.444 Base distance 43.43

- Click to show the all points on the interface
- Click to enter the point database and view the coordinates of the measured points. You can add, recover, import, and export the data. After selecting a point, you can check the details and take notes or photos.